WHAT IS CLAIMED IS:

1. A semiconductor device, comprising:

a copper wiring layer formed above a semiconductor substrate;

a pad electrode layer which conducts electrically to the copper wiring layer and has an alloy containing copper and a metal having a higher oxidation tendency than copper formed to reach bottom surface of the pad electrode layer; and

an insulating protective film having an opening extended to the pad electrode layer.

2. The semiconductor device according to claim 1, wherein the metal having the higher oxidation tendency than copper includes at least one selected from aluminum (Al), titanium (Ti), tantalum (Ta), zirconium (Zr), vanadium (V), tin (Sn), tungsten (W), cobalt (Co), iron (Fe), nickel (Ni), ruthenium (Ru), chromium (Cr), molybdenum (Mo), niobium (Nb), hafnium (Hf), magnesium (Mg) and beryllium (Be).

3. The semiconductor device according to claim 1, wherein a concentration of the metal having the higher oxidation tendency than copper is higher in a region near top surface of the pad electrode layer and becomes low under the region near the top surface.

4. The semiconductor device according to claim 3, wherein the concentration of the metal having the higher oxidation tendency than copper is 2 atm% or more in the region near the top surface.

5. The semiconductor device according to claim 1, wherein:

the pad electrode layer has an oxide layer, which is mainly comprising the metal having the higher oxidation tendency than copper, as an upper surface layer; and

a conductive substance is electrically connected to the pad electrode layer penetrating a part of the oxide layer.

6. The semiconductor device according to claim 1, wherein the pad electrode layer has a first oxide layer as an upper surface layer and is formed into a laminated form, below the first oxide layer, which includes a first alloy layer containing copper and the metal having the higher oxidation tendency than copper, a second oxide layer, and a second alloy layer in which a concentration of the metal having the higher oxidation tendency than copper is lower than the first alloy layer in this order.

7. The semiconductor device according to claim 1, wherein the pad electrode layer has a structure into which an insulating substance is intruded.

8. The semiconductor device according to claim 5, wherein the conductive substance is a conductive wire or a conductive bump, and bonded to the pad electrode layer.

9. The semiconductor device according to claim 1, wherein a concentration of copper in the pad electrode layer is 10 atm% or less on average from its surface to a depth of 2 nm.

10. A method of manufacturing a semiconductor device, comprising:

forming an insulating film above a semiconductor substrate;

forming a copper wiring layer in the insulating film;

forming an insulating protective film on the copper wiring layer;

forming an opening extended to the copper wiring layer in the insulating protective layer;

forming a film of a metal having a higher oxidation tendency

than copper or a film of an alloy containing a metal having a higher oxidation tendency than copper on the copper wiring layer in the opening; and

performing a thermal treatment to diffuse the metal or the alloy in the copper wiring layer so that an alloy containing copper and the metal whose oxidation tendency is higher than copper extended to bottom surface of the copper wiring layer is formed to form a pad electrode layer, and an oxide layer mainly comprising the metal is formed in top surface of the pad electrode layer.

11. A method of manufacturing a semiconductor device, comprising:

forming an insulating film above a semiconductor substrate;

forming a copper wiring layer in the insulating film;

forming an insulating protective film on the copper wiring layer;

forming an opening extended to the copper wiring layer in the insulating protective layer; and

forming a film of a metal whose oxidation tendency is higher than copper or a film of an alloy containing a metal whose oxidation tendency is higher than copper on the copper wiring layer in the opening while heating, thereby diffusing the metal or the alloy in the copper wiring layer so that an alloy containing copper and the metal whose oxidation tendency is higher than copper extended to bottom surface of the copper wiring layer is formed to form a pad electrode layer, and an oxide layer mainly comprising the metal is formed in top surface of the pad electrode layer.

12. A semiconductor device, comprising:

a wiring pad;

an insulating film, formed on the wiring pad, that has plural contact holes extended to the wiring pad; and

a conducting protective layer, disposed on the wiring pad via the insulating film, that is electrically connected to the wiring pad through the plural contact holes.

13. The semiconductor device according to claim 12, wherein the plural contact holes are disposed near periphery of the wiring pad.

14. The semiconductor device according to claim 12, wherein the contact holes have a diameter of 0.5μm or more to about 10μm or less.

15. A semiconductor device, comprising:

an insulating film having an opening;

plural insulating pillars disposed in the opening;

a wiring pad embedded in the opening to extend to midway of the opening; and

a conducting protective layer to the wiring pad which is disposed on the wiring pad so to fill the opening.

16. The semiconductor device according to claim 15, wherein the plural insulating pillars have a length of 0.5μm or more to 10μm or less between the adjacent pillars.

17. The semiconductor device according to claim 12, wherein a material for the wiring pad is Cu, and a material for the conducting protective layer is Al or an Al alloy.

18. The semiconductor device according to claim 15, wherein a material for the wiring pad is Cu, and a material for the conducting protective layer is a Cu alloy, Al or an Al alloy.

19. A semiconductor device, comprising:

a wiring disposed in a predetermined pattern above a substrate;

a protecting conductive layer disposed on a pad section of the wiring; and

a barrier film, disposed between the wiring and the protecting conductive layer, that is formed by stacking two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the metal element.

20. The semiconductor device according to claim 19, wherein the barrier film has each layer configuring the pair, the each layer being formed in a thickness of 5 nm or more to 30 nm or less.

21. The semiconductor device according to claim 19, wherein the barrier film is formed by stacking six pairs or less.

22. The semiconductor device according to claim 19, wherein the barrier film is formed of the same pairs only.

23. The semiconductor device according to claim 19, wherein the metal element is selected from Group IVa, Group Va or Group VIa.

24. The semiconductor device according to claim 23, wherein the compound is nitride.

25. The semiconductor device according to claim 24, wherein the wiring is formed of Cu, the protecting conductive layer is formed of Al, and the barrier film is formed of the pairs of Ta and Ta_2N.